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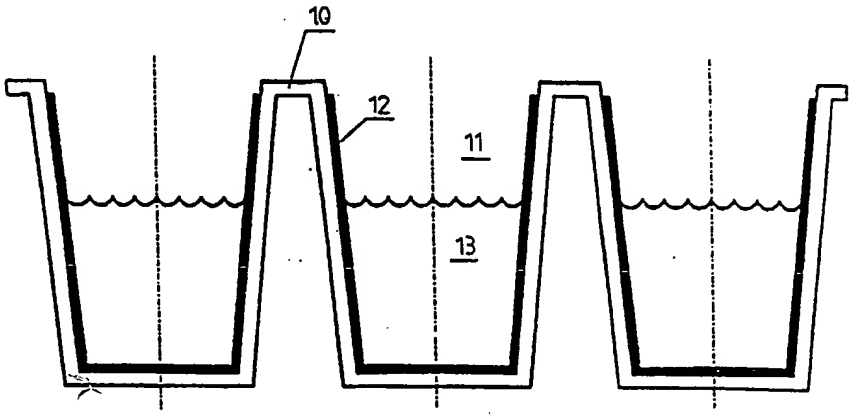
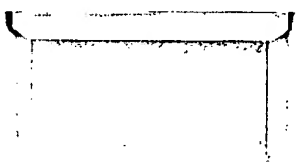
(54) Title: A SAMPLE PLATE WITH A PLURALITY OF SAMPLE WELLS OR VIALS INTENDED FOR RADIOLABELED BINDING ASSAYS



(57) Abstract

The present invention shows a new sample plate (10) with a plurality of sample wells or vials (11) intended for radiolabeled binding assays. A substantial part of said sample wells (11) of said sample plate (10) is produced from plastic scintillator. The inner surfaces of said sample wells (11) are coated with a binding compound (12) that specifically binds to the radiolabeled reactant which is being investigated and which is as a solution in said sample wells (11). The portion of said radiolabeled reactant that binds to said binding compound surface (12) is close enough to the walls of said sample wells (11) so that radiation emitted by said bound radiolabeled reactant can interact with the scintillation material of said walls of the sample wells (11). As a result of this interaction a part of the energy of the radiation is converted into light which can be measured by a proper apparatus which is beyond the scope of this patent specification.



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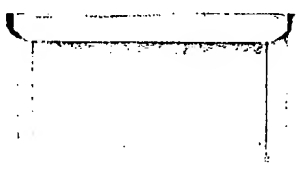


A SAMPLE PLATE WITH A PLURALITY OF SAMPLE WELLS OR VIALS INTENDED FOR RADIOLABELED BINDING ASSAYS

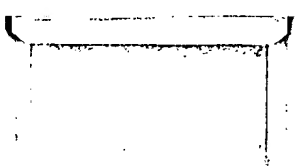
BACKGROUND OF THE INVENTION

A common technique in chemistry and biosciences is to coat suitable solid phases, such as microparticles or inner walls of test tubes, with a compound that can specifically bind a reactant in solution being investigated. Often, the mentioned reactant is radioactively labeled and gets bound onto the solid phase while the binding reaction proceeds. The amount of bound (sometimes unbound) radioactivity is then measured. This requires a procedure to separate the unbound fraction (in solution) from the bound fraction (on the solid phase).

A method to avoid the separation step is presented in US.Pat.No. 4,568,649. In this patent a plurality of small plastic support particles or beads (diameter about one micrometer) impregnated with a fluorescer are coated appropriately, and the beads are added into the solution containing the radiolabeled reactant.

Some common radiolabels (e.g. H-3 and I-125) emit low-energy electrons with short ranges (some micrometers) in water solutions and only the bound label gets close enough to the plastic so that the electrons can reach it and excite the fluorescer with subsequent light emission, the scintillation. The light is then detected with a suitable detector, such as a photomultiplier device.

However, the addition of beads is an extra step and there may be problems with buoyancy if the densities of the beads and the solution do not match. Furthermore, in some cases some loose nonspecific binding can occur requiring separation which is difficult to perform with beads. The present invention overcomes these drawbacks.



SUMMARY OF THE INVENTION

Besides of single tubes or cuvettes, multi-well sample plates which comprise several separate sample wells have become widespread test plates for in vitro analyses. The plates often have 96 wells arranged in eight rows and twelve columns, and the volume of each well is 200-300 micro-liters. The applicants have found that it is possible to prepare tubes, cuvettes or multi-well plates of plastic scintillator and to coat them with a binding compound enabling non-separation radiolabel binding assays with considerable simpleness.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a vertical section of a part of a sample plate which has several separate sample wells produced from a transparent plastic scintillator.

Figure 2 shows a vertical section of a part of a sample plate which has several separate sample wells produced from a two-layer transparent plastic sheet.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 shows a sample plate (10) with a plurality of sample wells (11) intended for radiolabeled binding assays. Said sample plate (10) can be produced from transparent scintillation plastic for example by a vacuum thermoforming or by an injection moulding process.

Said sample well (11) contains a test sample solution (13) including the radiolabeled reactant. The inner wall of said sample well (11) is coated with a binding compound (12) that specifically binds to the reactant being investigated.

The portion of said radiolabeled reactant that binds to said binding compound surface (12) is close enough to said wall of the sample well (11) so that radiation emitted by said bound radiolabeled reactant can interact with said plastic scintillator which converts a part of the absorbed energy into light which can be measured by a proper apparatus which is not shown here.

The radiation emitted by said radiolabeled reactant that does not bind to said binding compound coated surface (12) of said sample well (11) cannot interact with the plastic scintillator material of said sample well (11) because the distance of this portion of said radiolabeled reactant from the walls of said sample wells (11) normally exceeds the range of the radiation emitted by said radiolabeled reactant. Typically said reactant is labeled with low energy beta particles emitting isotope such as tritium (H-3). The maximum range of the beta particles emitted by tritium is only a few micrometers in said test sample solution (13).

Figure 2 shows an alternative construction of a sample plate (10) with a plurality of sample wells (11) intended for radiolabeled binding assays. In this case said sample plate (10) is produced from a two-layer transparent plastic sheet, where the inner layer (scintillation layer) (15) of said sample wells (11) is plastic scintillator and the outer layer (support layer) (16) is some suitable transparent plastic. This kind of plate can be produced by a vacuum thermoforming process.

The invention is not confined to the above embodiments alone, but it may show even considerable variation within the scope of the patent claims.

Plastic scintillators are well known for those skilled in the art. They are non-fluid solutions consisting of fluorescent organic additives, called fluors, dissolved in solidified polymer. The best polymers are aromatic

polystyrene and polyvinyltoluene and a common primary fluor is diphenyloxazole (PPO). Often a secondary fluor, such as 1,4-bis-2-(5-phenyloxazolyl)-benzene (POPOP), is added to obtain better match with the photomultiplier spectral response.

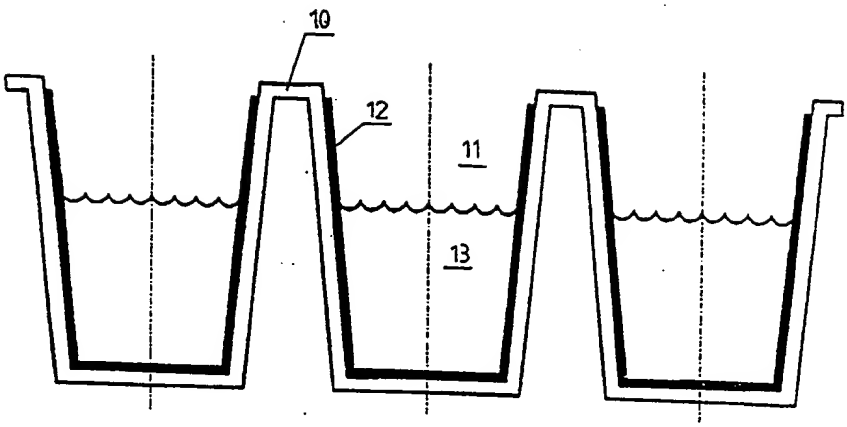
WHAT IS CLAIMED IS:

1. A sample plate with a plurality of sample wells or vials intended for radiolabeled binding assays, characterized in that said sample plate or said wells or vials of said sample plate are produced from scintillation plastic by a vacuum thermoforming or by an injection moulding process.

2. A sample plate according to claim 1, characterized in that said sample plate has only one sample well.

3. A sample plate according to claims 1 and 2, characterized in that the inner surfaces of said sample wells or vials of said sample plate are coated with a binding compound that specifically binds to the radiolabeled reactant being investigated.

Fig. 1.



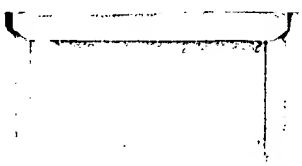
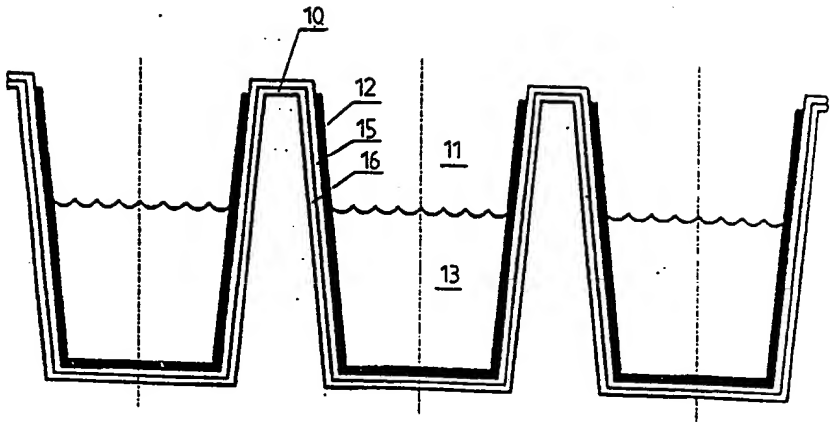


Fig. 2.



INTERNATIONAL SEARCH REPORT

International Application No PCT/FI 89/00191

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: B 01 L 3/00, G 01 N 33/543

II. FIELDS SEARCHED

Minimum Documentation Searched [7]	
Classification System	Classification Symbols
IPC5	B 01 L; G 01 N; G 01 T

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

SE,DK,FI,NO classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	WO, A1, 88/04429 (J.A. BURTON) 16 June 1988, see page 14 - page 16; figures 1,2,5,6 --	1-3
A	US, A, 3646346 (KEVIN J. CATT) 29 February 1972, see the whole document --	1-3
A	US, A, 4568649 (J.H. BERTOGLIO-MATTE) 4 February 1986, whole document (in the description) --	1-3

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* Special categories of cited documents: [10]

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
8th January 1990	1990 -01- 17
International Searching Authority	Signature of Authorized Officer
SWEDISH PATENT OFFICE	May Hallne

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ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO. PCT/FI 89/00191

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
08/11/89.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO-A1- 88/04429	16/06/88	NONE	
US-A- 3646346	29/02/72	NONE	
US-A- 4568649	04/02/86	NONE	